COSMIC in the Loop

Advantages of a Middleware for Embedded Software Developement

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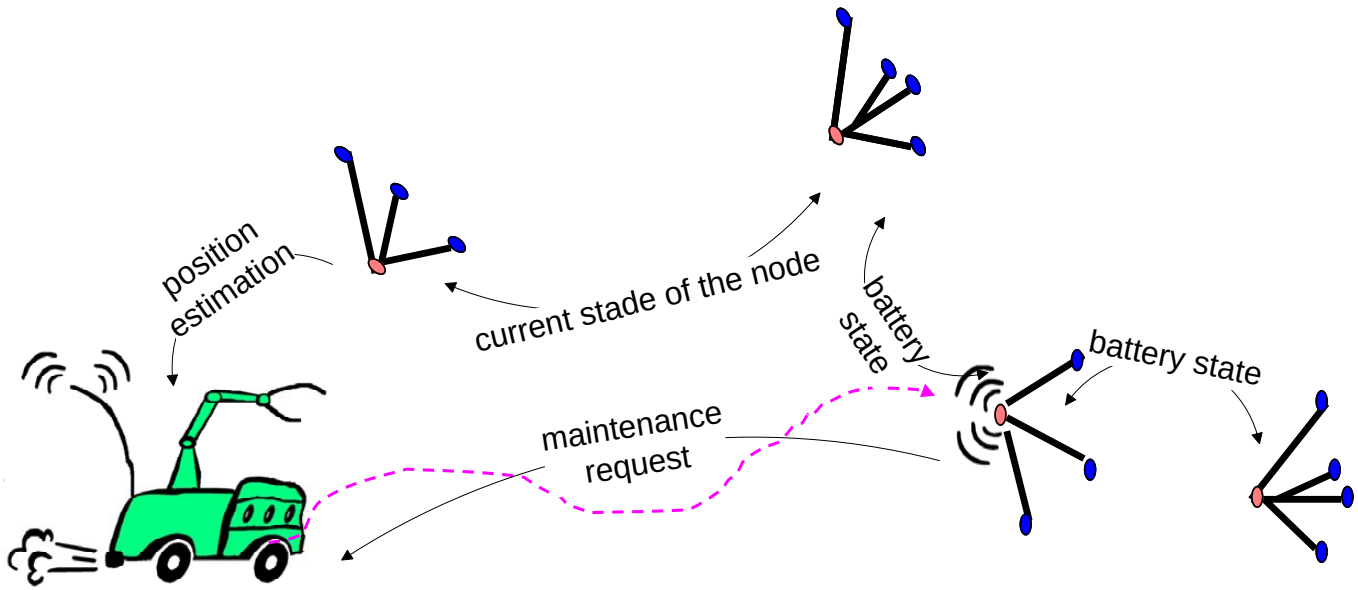
Motivation

Scenario: Mobile robot in a intelligent environment



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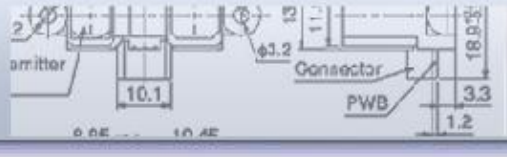


Challenges

- heterogeneity of the hardware
- widely differing networks and addressing mechanisms
- dynamic communication
- spontaneous generation of messages

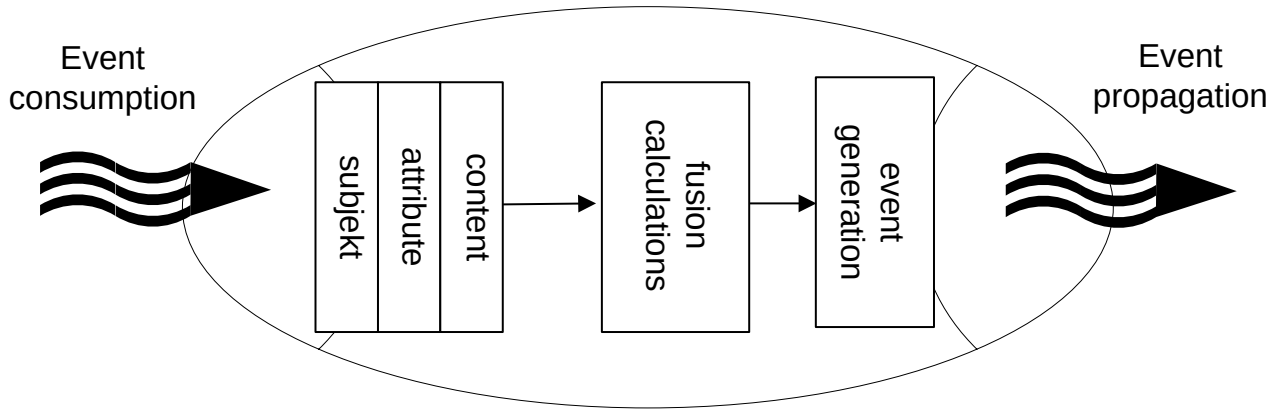
Objectives of the development of embedded systems

- flexible software development for embedded systems
- connection of simulation and real hardware

Interaction model

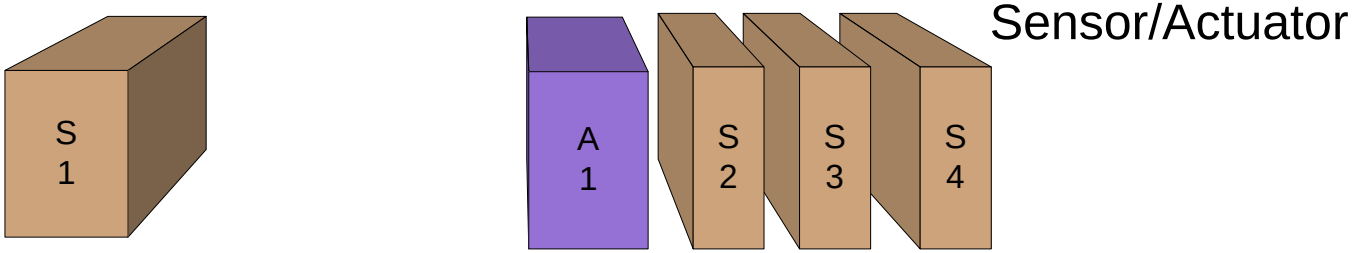
Model any occurrence in the environment or the system

- generated by a smart sensor component as reaction to an observation of its environment
- generated by a sentient object as the result of processing activities



Communication Abstraction

Event based communication



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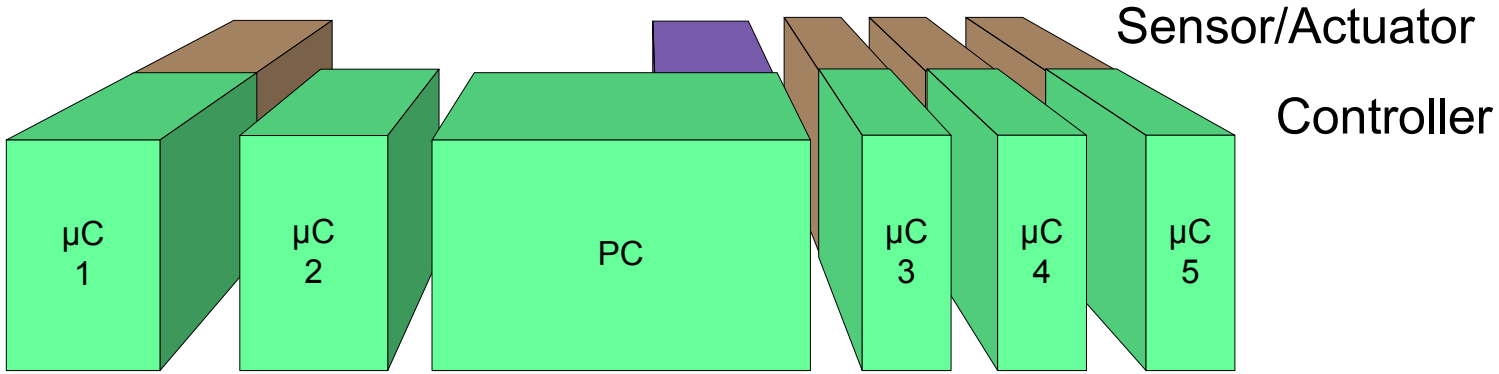

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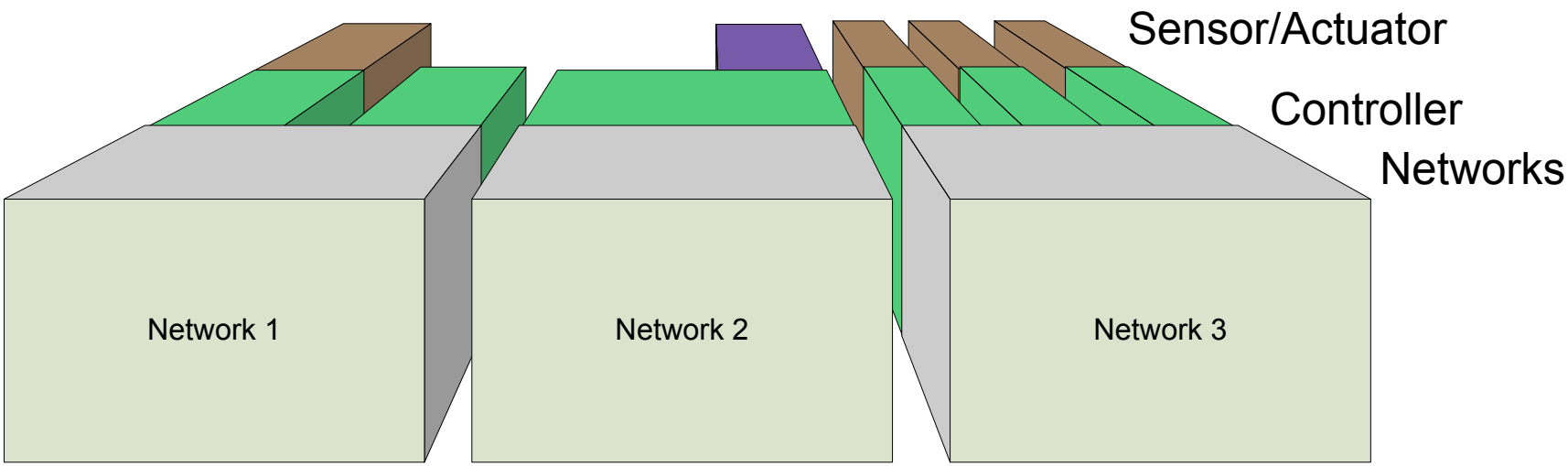

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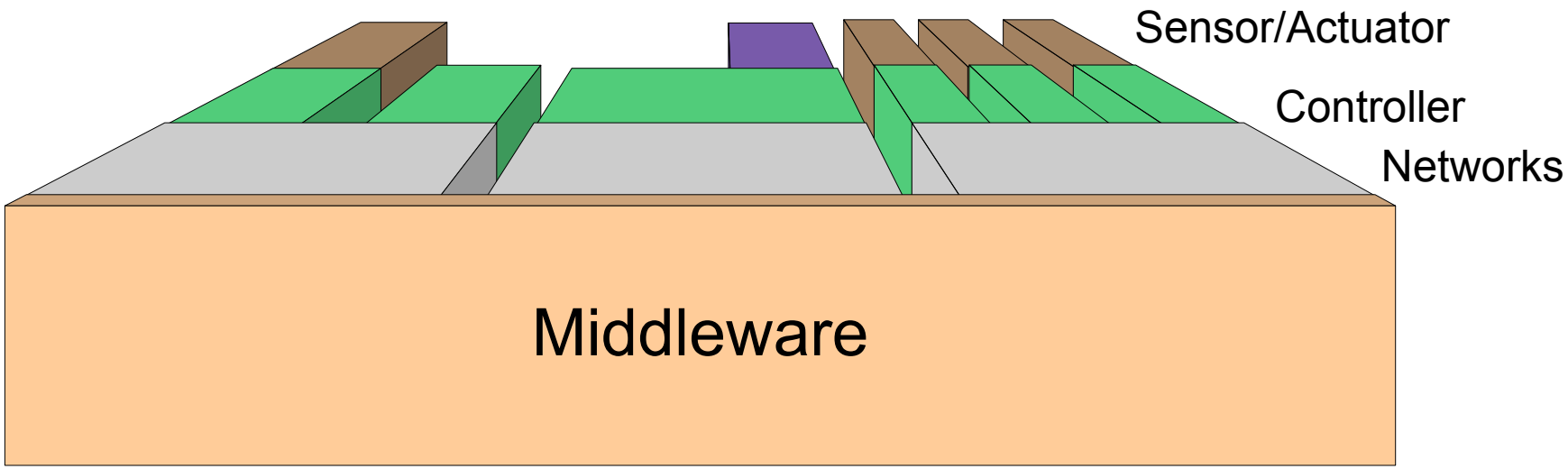

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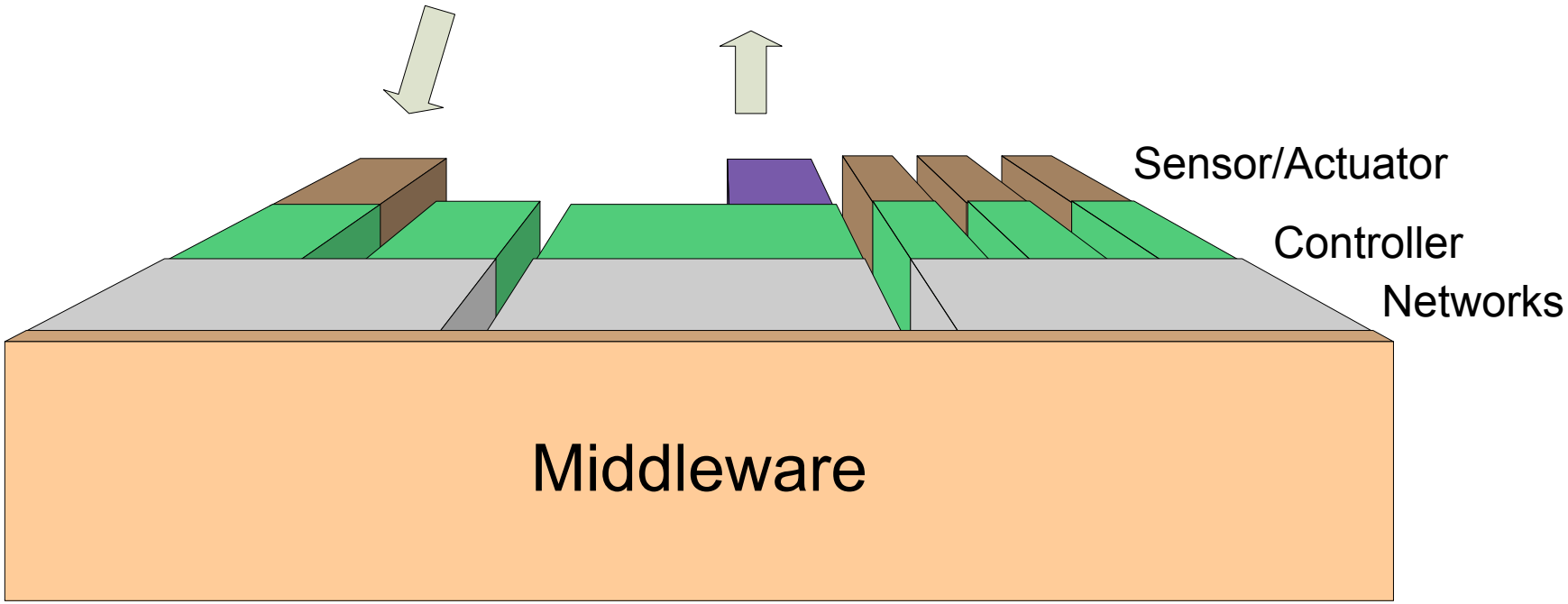

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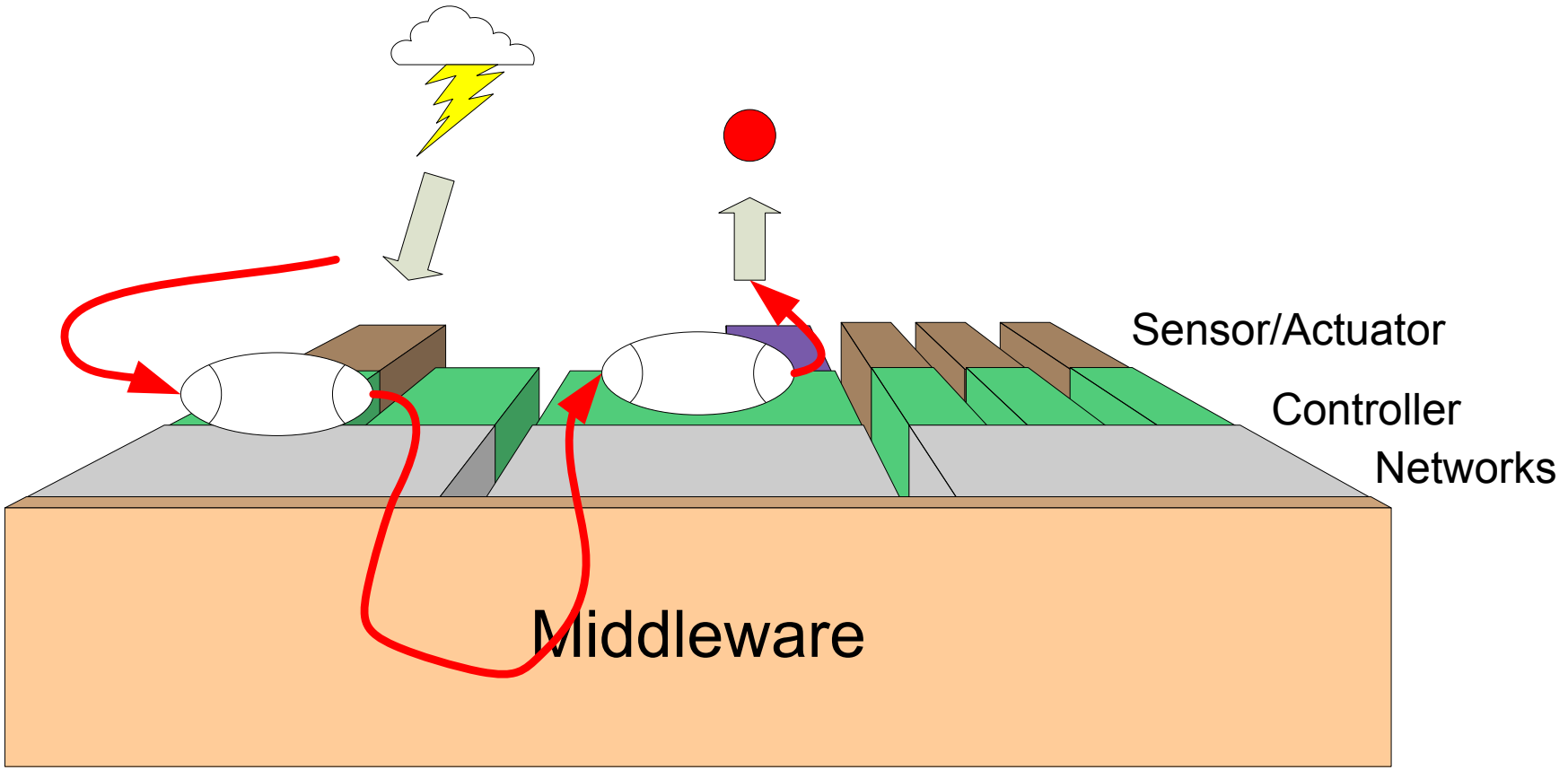


Communication Abstraction: Events

event channels

- provide dissemination guarantees
- support different synchrony classes
- encapsulate network configuration functions

```
distance_channel:= <UID, periodic soft real-time, ...
                    period, omission degree>
```

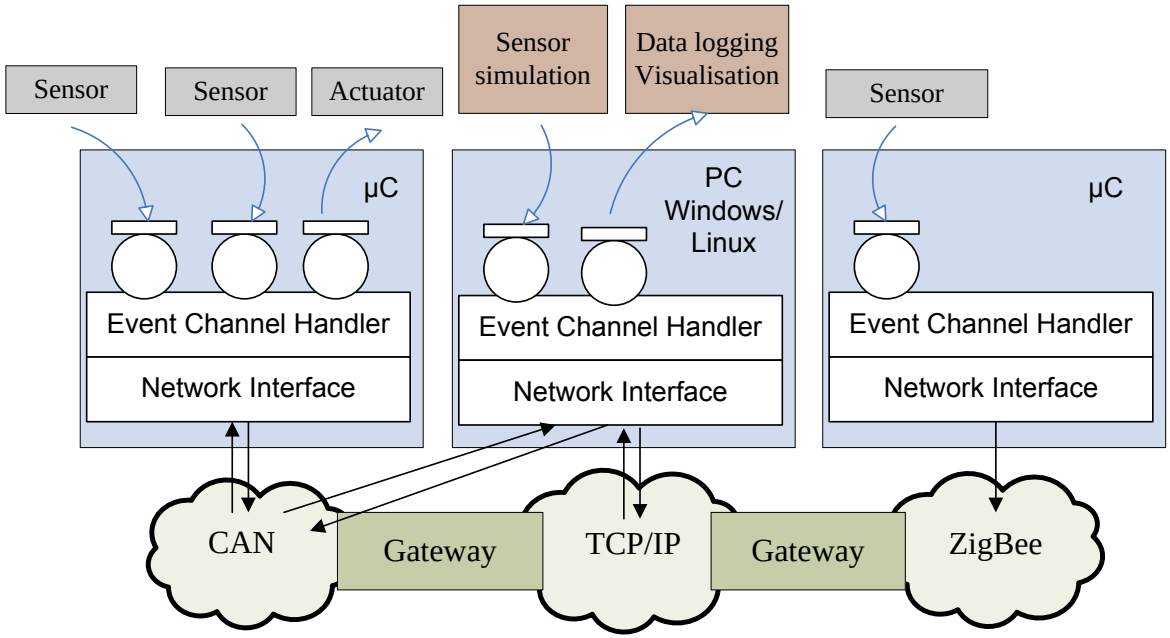
events

- treat as time/value entities
- allow to describe context and quality attributes

```
distance_event:= <UID, abs_pos, netw_zone, timestamp, ...
                  validity, distance>
```

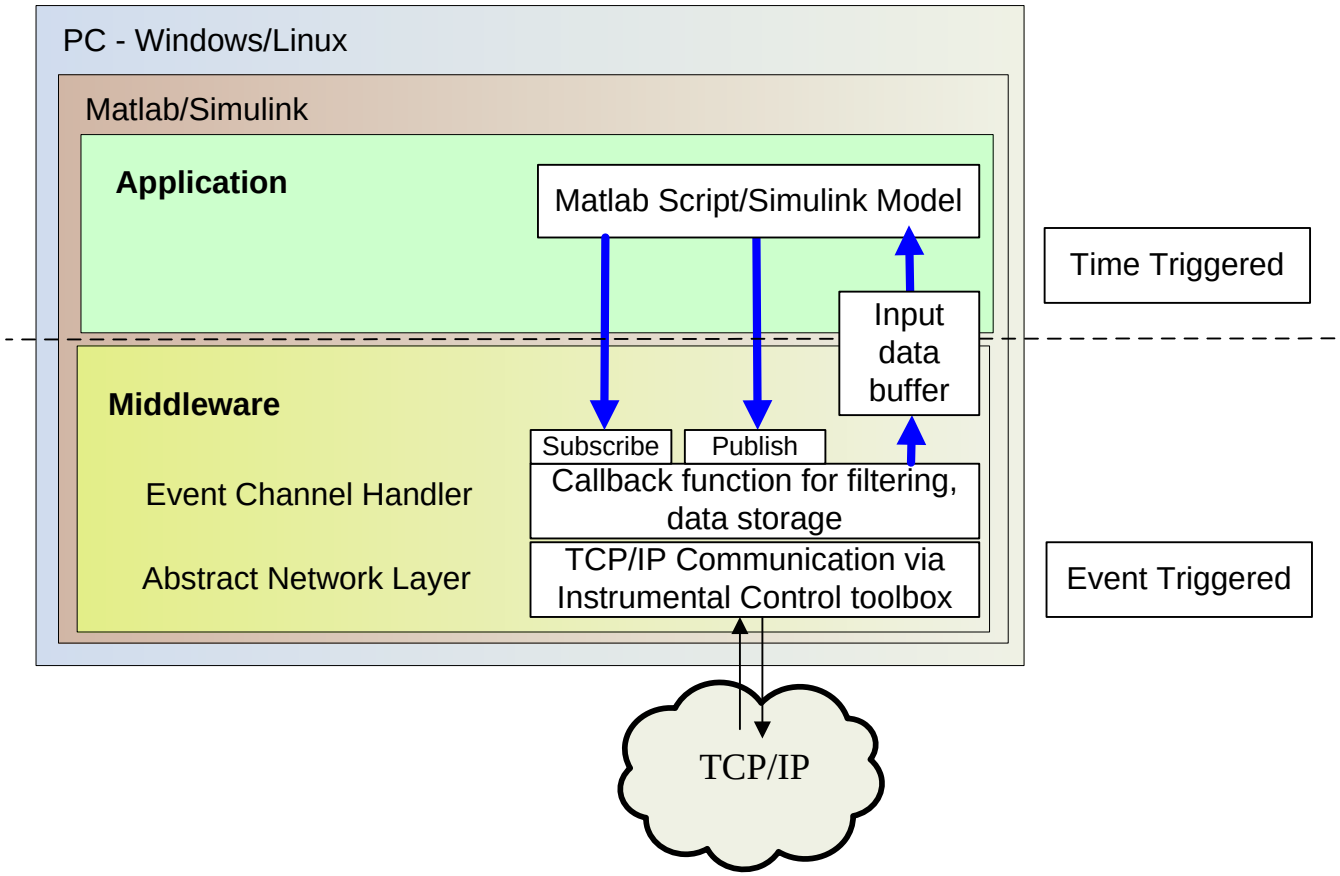
COSMIC Middleware

COoperating **sm**art Dev**ic**es



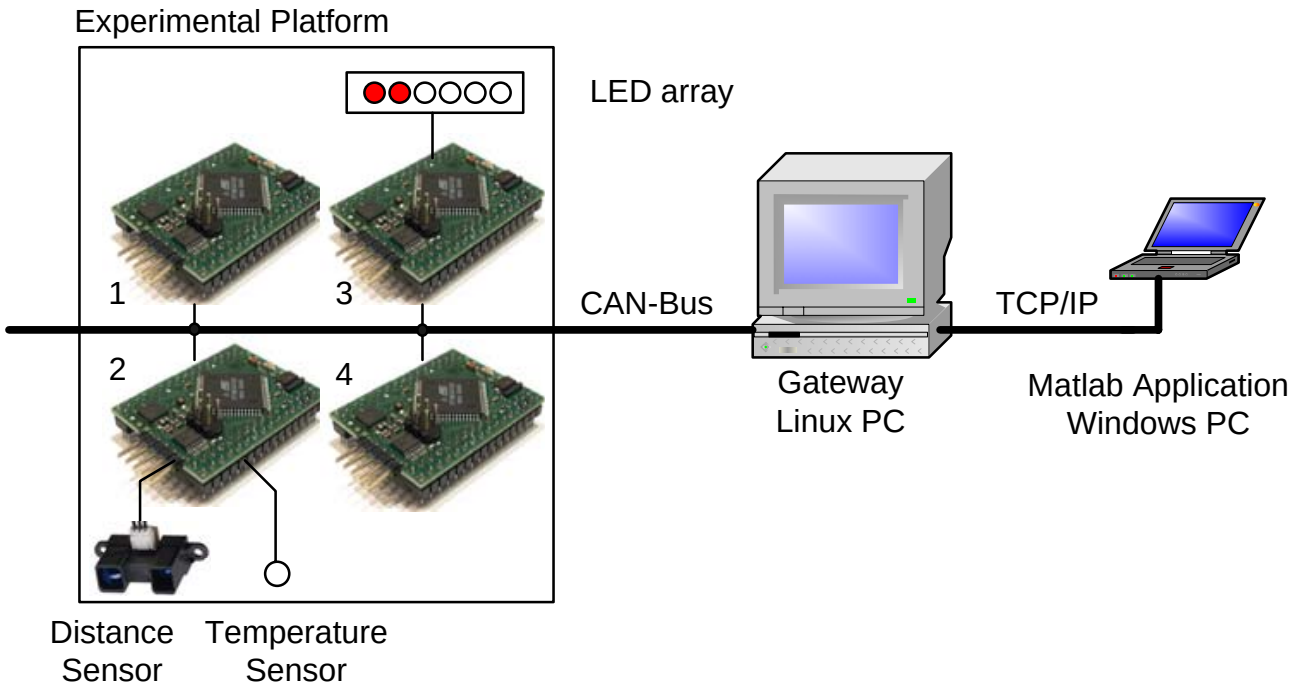
- event based communication
- publish / subscribe mechanism
- different real-time Levels

Matlab Implementation



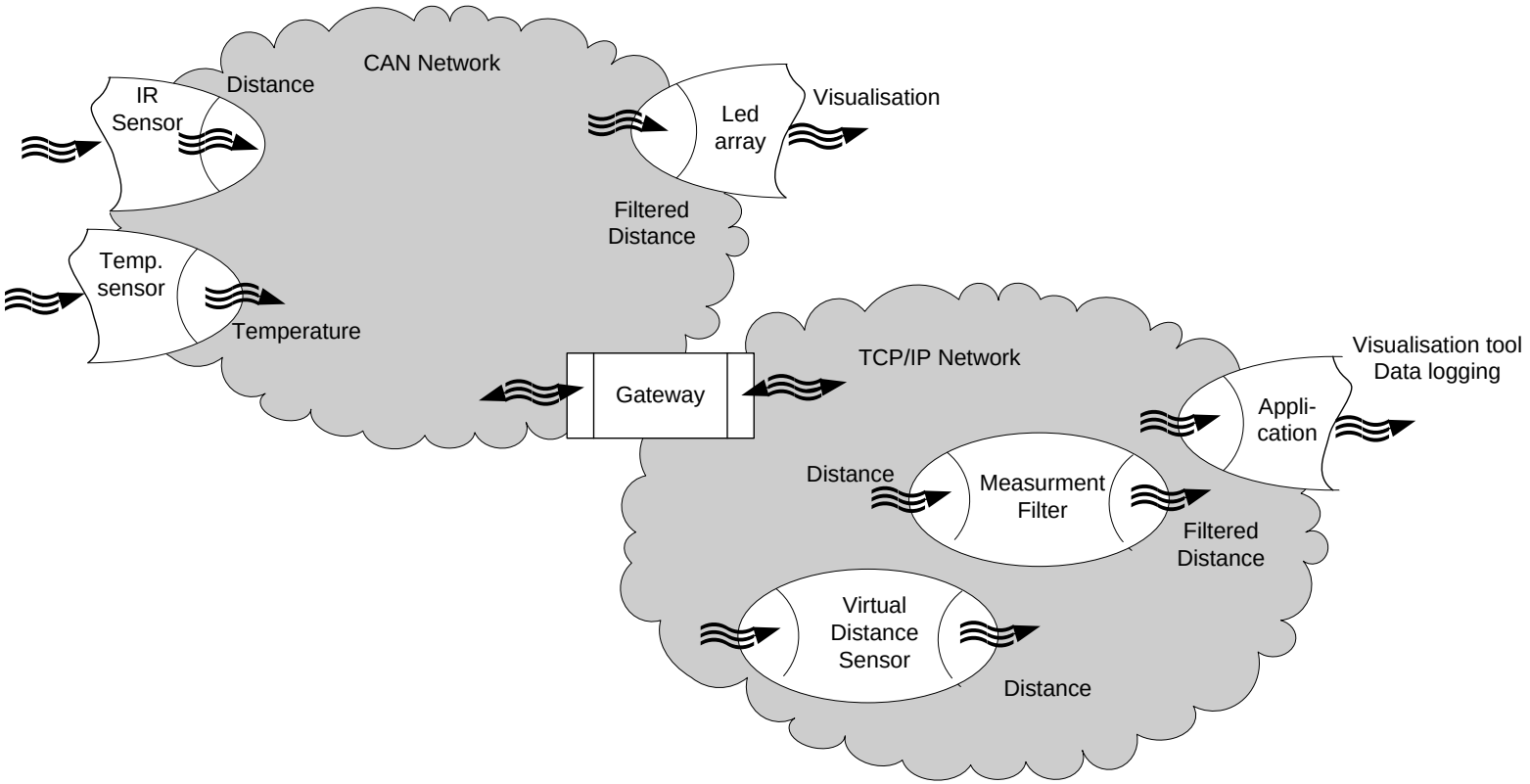
Test Platform

Structure of the experimental setup



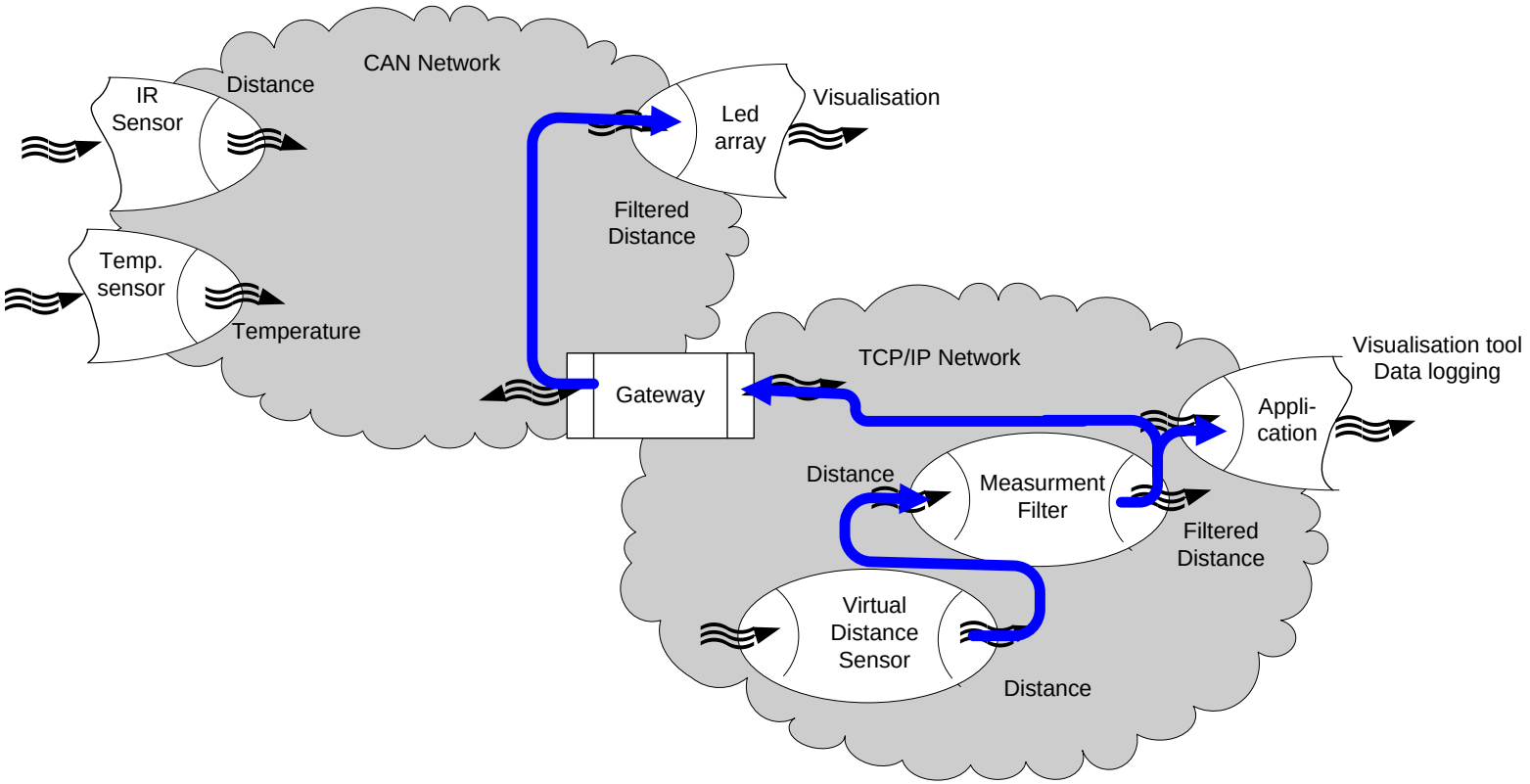
Scenario description

Scenario modeled with sentient objects



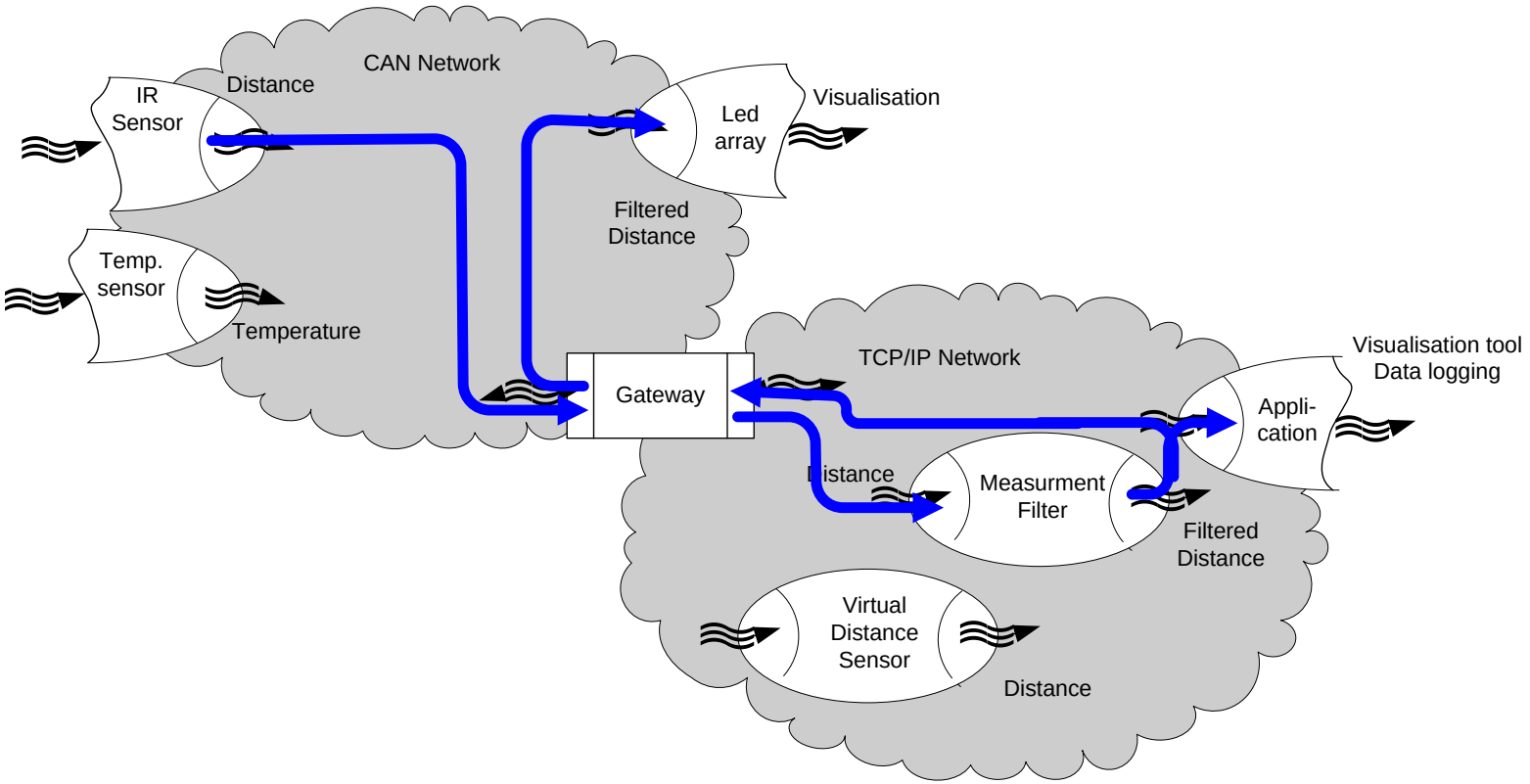
Scenario description

Software in the Loop environment



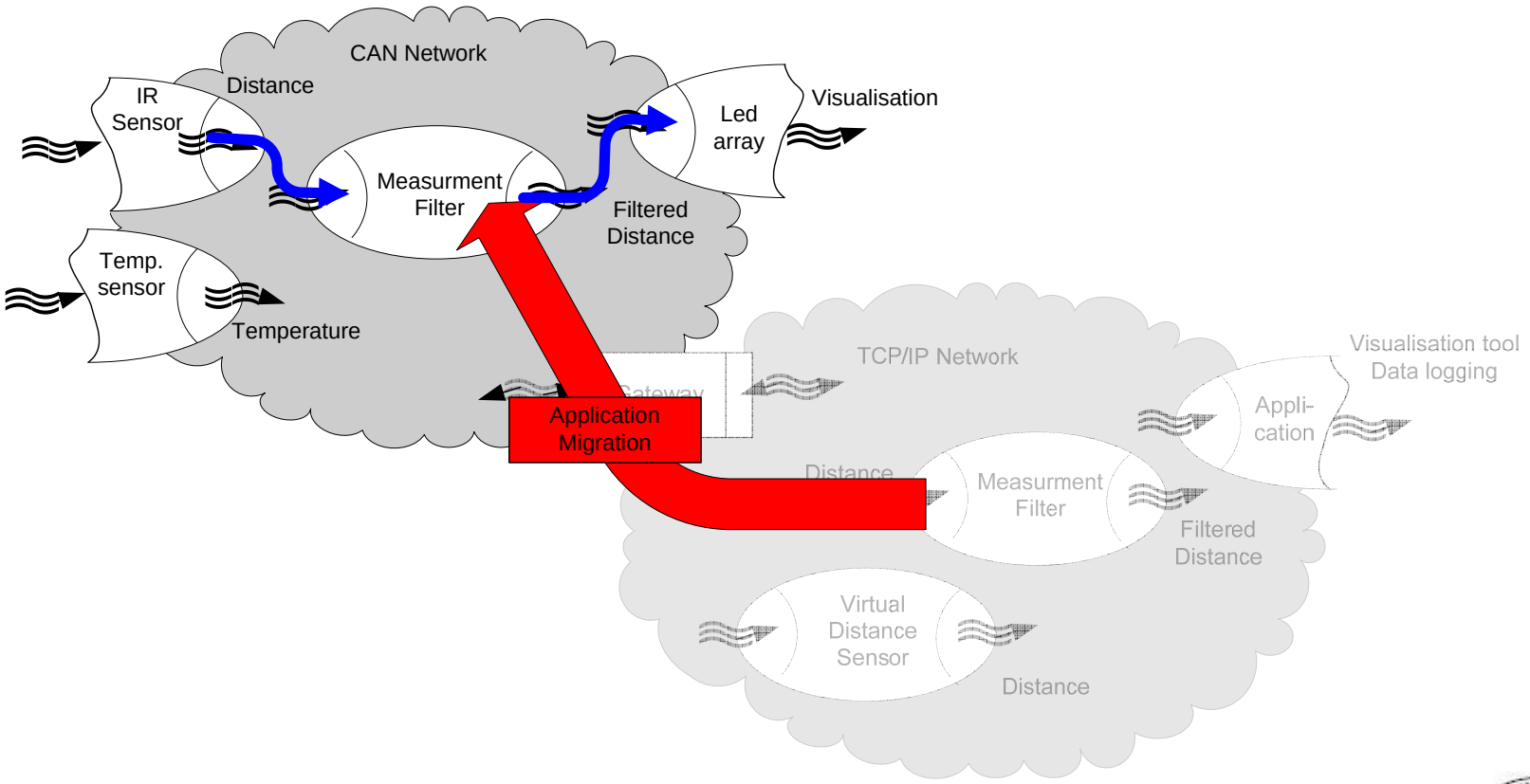
Scenario description

Hardware in the Loop environment



Scenario description

Final embedded platform

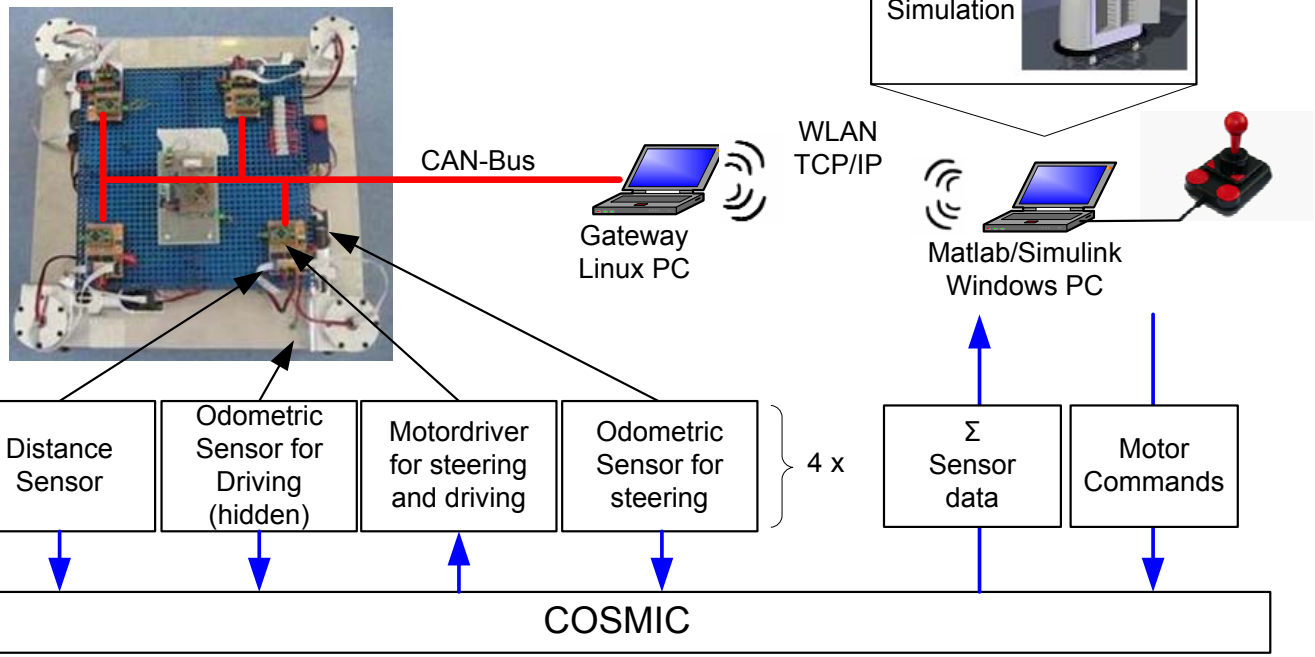


Conclusions

Benefits

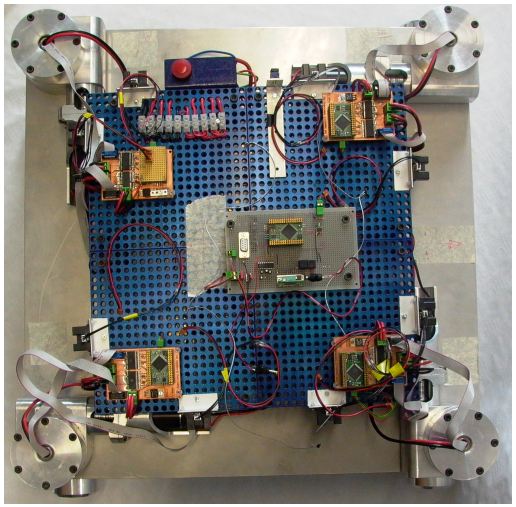
- uniform communication interface for application developers
- dynamic interaction
- reusebility of sentient objects
- using Matlab / Simulink in distributed applications
  - predefined sensor values for reproducible experiments
  - combination of simulation and real hardware

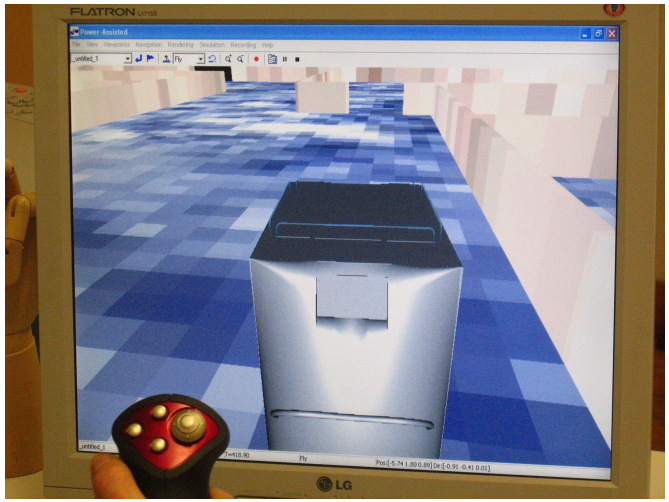
Transport Platform Q



State of the affairs

Steering via COSMIC from Simulink



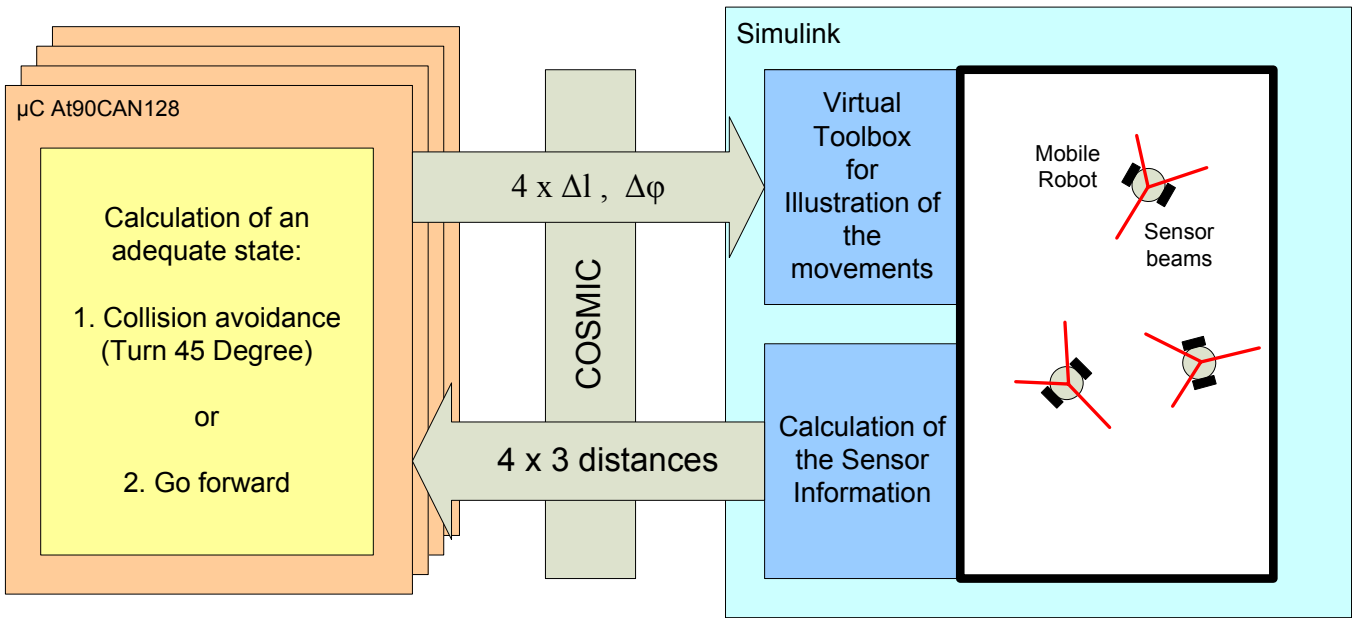


Idea

General

We use the 4 nodes of the experimental setup to simulated, „blind“ robots moving in a box together and try to avoid collisions.

Structure



Thanks for your interest